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TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371

A0-1269

U.S. APPLICATION NO. (If known, see 37 CFR 1.5)

09/700863

INTERNATIONAL APPLICATION NO.
PCT/GB 99/01631INTERNATIONAL FILING DATE
21 May 1999 (21.05.99)PRIORITY DATE CLAIMED
23 May 1998 (23.05.98)TITLE OF INVENTION
PEST CONTROL

APPLICANT(S) FOR DO/EO/US

HOWSE, Philip, Edwin

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:


1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
 2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
 3. ☒ This is an express request to promptly begin national examination procedures (35 U.S.C. 371(f)).
 4. ☐ The US has been elected by the expiration of 19 months from the priority date (PCT Article 31).
 5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
 - a. ☐ is attached hereto (required only if not communicated by the International Bureau).
 - b. ☒ has been communicated by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
 6. ☐ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
 7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
 - a. ☐ are attached hereto (required only if not communicated by the International Bureau).
 - b. ☐ have been communicated by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☐ have not been made and will not be made.
 8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
 9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
 10. ☐ An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).
- Items 11 to 16 below concern document(s) or information included:
11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
 12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
 13. ☒ A **FIRST** preliminary amendment.
☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
 14. ☐ A substitute specification.
 15. ☐ A change of power of attorney and/or address letter.
 16. ☒ Other items or information: Postcard

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U.S. APPLICATION NO. (if known, see 37 CFR 1.5)		INTERNATIONAL APPLICATION NO.		ATTORNEY'S DOCKET NUMBER	
09/700863		PCT/GB99/01631		A0-1269	
17. <input checked="" type="checkbox"/> The following fees are submitted:				CALCULATIONS PTO USE ONLY	
BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)): Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO \$1000.00 International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO \$860.00 International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$710.00 International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4) \$690.00 International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) \$100.00					
ENTER APPROPRIATE BASIC FEE AMOUNT =				\$	860.00
Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)).				\$	
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	57 - 20 =	37	X \$18.00	\$	666.00
Independent claims	4 - 3 =	1	X \$80.00	\$	80.00
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ \$270.00	\$	
TOTAL OF ABOVE CALCULATIONS =				\$	1606.00
<input checked="" type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.				\$	803.00
SUBTOTAL =				\$	803.00
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				\$	
TOTAL NATIONAL FEE =				\$	803.00
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property				\$	
TOTAL FEES ENCLOSED =				\$	803.00
				Amount to be refunded:	\$
				charged:	\$ 803.00
a. <input checked="" type="checkbox"/> A check in the amount of \$ <u>803.00</u> to cover the above fees is enclosed.					
b. <input type="checkbox"/> Please charge my Deposit Account No. _____ in the amount of \$ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.					
c. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. <u>08-0960</u> . A duplicate copy of this sheet is enclosed.					
NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.					
SEND ALL CORRESPONDENCE TO:					
Domenica N.S. Hartman HARTMAN AND HARTMAN, P.C. 552 East 700 North Valparaiso, IN 46383					
 SIGNATURE:					
Domenica N.S. Hartman NAME					
<u>32,701</u> REGISTRATION NUMBER					

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IN THE INTERNATIONAL BUREAU

International Application No. PCT/GB99/01631

Applicant: Howse, Philip, Edwin

Agent's Reference No. A0-1269

International Filing Date: 21 May 1999 (21.05.99)

Priority Date: 23 May 1998 (23.05.98)

PEST CONTROL

PRELIMINARY AMENDMENT

Please amend the claims of the above-identified international patent application by replacing sheets 16 to 23 of the international application with the following replacement sheets, numbered 16 to 23.

The differences between the claims as filed and those on the replacement sheets 8 to 15 are as follows:

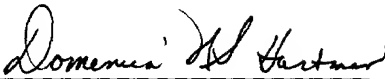
Claims 1 to 3, 6 to 8, 11, 13, 15, 16, 18, 21, 23 to 25, 28, 30, 33, 35, 37, 38, 40, 43, 45, 46, 51, 52, 56, and 57 are unchanged; claims 4, 5, 7, 9, 10, 12, 14, 17, 19, 20, 22, 26, 27, 29, 31, 32, 34, 36, 39, 41, 42, 44, 47 to 50, 53, 54, and 55, are replaced by amended claims bearing the same numbers.

REMARKS

Claims 4, 5, 7, 9, 10, 12, 14, 17, 19, 20, 22, 26, 27, 29, 31, 32, 34, 36, 39, 41, 42, 44, 47 to 50, 53, 54, and 55 have been amended to eliminate the multiple dependent claims.

Should the Examiner have any questions with respect to any matter now of record,
Applicant's representative may be reached at (219) 462-4999.

Respectfully submitted,

By 
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November 21, 2000
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CLAIMS

1. A method of controlling a pest by at least partially coating the pest with a particulate material (7, 17) incorporating a killing or behavior-modifying agent which method comprises directing, attracting or otherwise luring the pest on to, above or otherwise adjacent a surface (4, 14) bearing such a particulate material (7, 17) to render the material (7) airborne by the movement off the pest on, above, or in the region of the particulate material-bearing surface (4, 14).
2. A method according to claim 1, wherein the particulate material (7, 17) is a powder which is sufficiently fine for it to be rendered airborne by a pest moving across, flying above, or adjacent, or taking-off from the particulate material-bearing surface (4, 14), so that the pest becomes at least partially coated with the powder.
3. A method according to claim 2, wherein the powder (7) comprises or is combined with at least one biological, synthetic or natural pesticide as a killing agent.
4. A method according to claim 1, wherein the pest is an insect pest.
5. A method according to claim 1, wherein the particulate material (7, 17) is charged electrostatically as it is rendered airborne from the particulate material-bearing surface (4, 14).
6. A method according to claim 5, wherein the particulate material (7) is charged by friction.

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7. A method according to claim 1, wherein the surface (4, 14) is associated with a trap (1, 11), comprising an electrically insulating material.
8. A method according to claim 7, wherein the electrically insulating material comprises a plastics material.
9. A method according to any claim 1, including providing a pheromone or parapheromone attractant (5, 15) for luring pests to be controlled.
10. A method according to claim 1, wherein the surface (4) is coated with a fine powder (7) which is charged electrostatically.
- 10 11. A method according to claim 10, wherein the powder (7) is capable of retaining its electrostatic charge for long periods on the surface (4).
12. A method according to claim 1, wherein undesired removal or loss of the particulate material (7, 17) from the surface (4, 14) is eliminated or at least substantially reduced.
- 15 13. A method according to claim 12, wherein undesired removal or other loss of the particulate material (7) from the surface (4) is eliminated or at least substantially reduced by means of raised edges (9), preferably rounded, at the periphery on the surface (4).
14. A method according to claim 1, wherein the particulate material (7, 17) is accommodated in at least one recess (6) or trough (16) associated with the particulate material bearing surface (4, 14).
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15. A method according to claim 14, wherein the particulate material (7) is accommodated in at least one recess (6) provided in the particulate material bearing surface (4).
- 5 16. A method according to claim 15, wherein the upper periphery of the or each recess (6) is provided with raised edges (10).
17. A method according to claim 1, wherein the particulate material-bearing surface (4) is provided on a plate (2) which is preformed and stands alone preferably upon feet (8).
- 10 18. A method according to claim 14, wherein the particulate material-bearing surface (14) comprises at least one trough (16) in which the particulate material (17) is accommodated.
- 15 19. A method according claim 14, wherein the dimensions of the or each recess (6) or the or each trough (16), as the case may be, in which the particulate material (7, 17) is accommodated, are generally smaller than those of the pests to be controlled.
20. A method according to claim 1, wherein the surface (4) comprises part of a tubular trap (1).
21. A method according to claim 20, wherein the trap (1) is provided with a triangular cross-section.
- 20 22. A method according to claim 20, wherein the surface (4) is an interior surface of the trap (1).

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23. Pest control apparatus comprising a surface (4, 14) on to, or above or in the region of which a pest is capable of being directed, attracted or otherwise lured and which bears a particulate material (7, 17) incorporating a killing or behavior-modifying agent, wherein the particulate material (7, 17) is capable of being rendered airborne by movement of the pest on, above, or in the region of the particulate material-bearing surface (4, 14).
24. Apparatus according to claim 23, wherein the particulate material (7, 17) is a powder which is sufficiently fine for it to be rendered airborne by a pest moving across, flying above, or in the region of; or taking-off from the particulate material-bearing surface (4, 14), so that the pest, becomes at least partially coated with the powder.
25. Apparatus according to claim 24, wherein the powder (7, 27) comprises or is combined with at least one biological, synthetic or natural pesticide as a killing agent.
26. Apparatus according to claim 23, wherein the pest is an insect pest.
27. Apparatus according to claim 23, wherein the particulate material (7, 17) has properties which enable it to become charged electrostatically as it is rendered airborne from the particulate material-bearing surface (4, 14).
28. Apparatus according to claim 27, wherein the particulate material (7, 17) is charged by friction.
29. Apparatus according to claim 23, wherein the surface (4, 14) is

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associated with a trap (1, 11), comprising an electrically insulating material.

30. Apparatus according to claim 29, wherein the electrically insulating material comprises a plastics material.

5 31. Apparatus according to claim 23, comprising a pheromone or parapheromone attractant (5, 15).

32. Apparatus according to claim 23, wherein the surface (4) is coated with a fine powder (7) which is charged electrostatically.

10 33. Apparatus according to claim 32, wherein the powder (7) is capable of retaining its electrostatic charge for long periods on the trap surface (4).

34. Apparatus according to claim 23, wherein undesired removal or loss of the particulate material (7, 17) from the surface (4, 14) is eliminated or at least substantially reduced.

15 35. Apparatus, according to claim 34, wherein undesired removal or other loss of the particulate material (7) from the surface (4) is eliminated or at least substantially reduced by raised edges (9), preferably rounded, at the periphery of the surface (4).

20 36. Apparatus according to any of claim 23, wherein the particulate material (7, 17) is accommodated in at least one recess (6) or trough (16) associated with the particulate material-bearing surface (4, 14).

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37. Apparatus according to claim 36, wherein the particulate material (7) is accommodated in at least one recess (6) provided in the particulate material-bearing surface (4).
- 5 38. Apparatus according to claim 37, wherein the upper periphery of the or each recess (6) has raised edges (10).
39. Apparatus according to claim 23, wherein the particulate material-bearing surface (4) is on a plate (2) which is preformed and stands alone, preferably upon feet (8).
- 10 40. Apparatus according to claim 36, wherein the particulate material-bearing surface (14) comprises at least one trough (16) in which the particulate material (17) is accommodated.
- 15 41. Apparatus according to claim 36, wherein the dimensions of the or each recess (6) or the or each trough (16), as the case may be, in which the particulate material (7, 17) is accommodated, are generally smaller than those of the pests to be controlled.
42. Apparatus according to claim 23, wherein the surface (4) comprises part of a tubular trap (1).
43. Apparatus according to claim 42, wherein the trap (1) has a triangular cross-section.
- 20 44. Apparatus according to claim 42, wherein the surface (4) is an interior surface of the trap (1).

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45. A pest control trap (1, 11) comprising a surface (4, 14) having at least one recess (6, 16) therein, wherein a particulate material (7, 17) incorporating a pest killing or behavior-modifying agent, is accommodated in the or each recess (6, 16).
- 5 46. A trap (1, 11) according to claim 45, wherein the or each recess (6, 16) has dimensions which are generally smaller than those of pests to be controlled.
- 10 47. A trap (1, 11) according to claim 45, wherein the particulate material (7, 7) is capable of being rendered airborne by movement of a pest in the vicinity thereof.
48. A trap (1, 11) according to claim 27, wherein the particulate material (7, 17) is a fine powder.
49. A trap (1, 11) according to claim 45, wherein the particulate material is capable of being electrostatically charged.
- 15 50. A trap (1, 11) according to claim 45, wherein the particulate material (7, 17) is chargeable by friction as it is rendered airborne, for subsequent contamination of a pest in the vicinity thereof.
- 20 51. A method of preventing the dispersion of a pest-contaminating particulate material (7, 17) from a pest trap (1, 11), which method comprises accommodating the material (7, 17) in at least one recess (6, 16) in a surface (4, 14) of the trap (1, 11).
52. A method according to claim 51, wherein the particulate material (7,

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17) comprises a fine powder.

53. A method according to claim 51, wherein the pest-contaminating particulate material (7, 17) is protected from wind action.

5 54. A method according to claim 51, wherein the particulate material (7, 17) is attached to a pest as it flies in the region of or takes-off from the surface (4, 14).

55. A method according to claim 51, wherein the pest is flying insect pest.

56. A method according to claim 55, wherein downthrust of air generated by the pest's wing beats, renders the particulate material (7) airborne.

10 57. A method according to claim 56, wherein, as the material (7, 17) becomes airborne, it is charged electrostatically, so that it will adhere to the pest.

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PEST CONTROLDESCRIPTION

5 This invention relates to the control of pests, such as, insect pests, and is especially, but not exclusively, related to the control of flying or crawling insect pests.

10 The constant pressure of pesticide use in agriculture can lead to the development of pesticide-resistance amongst insect pest species, resulting in the killing of non-target animals including beneficial predators and parasites which tend to maintain a natural balance of the pest species. Also, it leads to the contamination of the environment with consequential harmful effects on human and animal health, resulting from exposure to pesticide residues in water and comestible products.

15 Therefore, it is desirable to target pest species accurately and to minimise the amount of pesticide which finds its way into the environment and/or on to non-target animals and organisms.

20 In International Patent Application No. PCT/GB93/01442 (Publication No. WO94/00980), there is disclosed means for targeting accurately pest species, such disclosure including a method of luring one sex of an insect pest species to a bait using that insect pests' sexual pheromone, usually in the form of a volatile attractant, contaminating that insect pest with electrostatically-charged powder or other particulate material formulated with a suitable slow-acting killing agent or

25 behaviour-modifying chemical and allowing the so-contaminated insect pest to contaminate other insect pests of the opposite sex during mating attempts. For this method to operate, it is desirable that as much as possible of the powder or other particulate material is picked up by the target insect pest and not lost into the environment by the action of wind and weather, where it can affect non-target

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animals or organisms.

Accordingly, it is an object of the present invention to provide various methods of and means for controlling pests, such as flying or crawling insect pests, which overcome, or at least substantially reduce, the disadvantages associated with the known pest control methods discussed above.

One aspect of the invention provides a method of controlling a pest by at least partially coating the pest with a particulate material incorporating a killing or behaviour-modifying agent, which method comprises directing, attracting or otherwise luring the pest on to, above, or otherwise adjacent a surface bearing such a particulate material to render the material airborne by the movement of the pest on, above, or in the region of the particulate material-bearing surface.

The particulate material is preferably a powder which is sufficiently fine for it to be rendered airborne by a pest moving across, flying above or adjacent, or taking-off from the particulate material-bearing surface, so that the pest becomes at least partially coated with the powder.

The powder may comprise or be combined with at least one biological, synthetic or natural pesticide as a killing agent and, generally, the particulate material may be charged electrostatically, preferably by friction, as it is rendered airborne from the particulate material-bearing surface.

The surface is preferably associated with a trap having an electrically insulating material which may comprise a plastics material.

The inventive method may include providing a pheromone or parapheromone attractant for luring pests to be controlled and the surface may

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be coated with a fine powder which is charged electrostatically, preferably retaining its electrostatic charge for long periods on the surface.

5 Any undesired removal or loss of the particulate material from the surface may be eliminated or at least substantially reduced, for example, by means of raised edges, preferably rounded, at the periphery of the surface.

10 Alternatively or additionally, the particulate material can be accommodated in at least one recess or trough associated with the particulate material-bearing surface, preferably in at least one recess provided in the surface. Also, the upper periphery of the or each recess may be provided with raised edges.

15 Further, the particulate material-bearing surface may be provided on a plate which is preformed and stands alone, that is, free-standing, preferably upon feet.

Alternatively, the particulate material-bearing surface can comprise at least one trough in which the particulate material is accommodated.

20 In any event, the dimensions of the or each recess or the or each trough in which the particulate material is accommodated, are preferably generally smaller than those of the pests to be controlled.

25 In a preferred embodiment, the surface comprises part of a tubular trap, preferably of triangular cross-section and open-ended, in which case, the surface may be an interior surface of the trap of which at least part, and preferably a major proportion, may be coated with the particulate material, such as a fine powder, which, as indicated above, may be charged electrostatically, preferably by friction.

A second aspect of the invention resides in pest control apparatus comprising

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5 a surface on to, above or in the region of which a pest is capable of being directed, attracted or otherwise lured and which bears a particulate material incorporating a killing or behaviour-modifying agent, wherein the particulate material is capable of being rendered airborne by movement of the pest on, above, or in the region of the particulate material-bearing surface.

10 The particulate material is preferably a powder which is sufficiently fine for it to be rendered airborne by a pest moving across, flying above or in the region of, or taking-off from the particulate material-bearing surface, so that the pest becomes at least partially coated with the powder which may comprise or be combined with at least one biological, synthetic or natural pesticide as a killing agent.

15 The particulate material may have properties which enable it to become charged electrostatically as it is rendered airborne from the particulate material-bearing surface, preferably its being chargeable by friction.

The surface can be is associated with a trap comprising an electrically insulating material, preferably a plastics material.

20 The inventive apparatus may also comprise a pheromone or parapheromone attractant.

25 Further, the surface may be coated with a fine powder which is charged electrostatically, preferably being capable of retaining its electrostatic charge for long periods on the trap surface.

Any undesired removal or loss of the particulate material from the surface may be eliminated or at least substantially reduced, preferably by raised edges, such as raised and rounded edges, at the periphery of the surface.

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5 In an embodiment of inventive apparatus, the particulate material is accommodated in at least one recess or trough associated with the particulate material-bearing surface. At least one recess may be provided in the particulate material-bearing surface, in which case, the upper periphery of the or each recess may have raised edges.

10 In another embodiment, the particulate material-bearing surface is on a plate which is preformed and stands alone, namely, free standing, preferably upon feet. Alternatively, the particulate material-bearing surface comprises at least one trough in which the particulate material is accommodated, with the dimensions of the or each recess or the or each trough in which the particulate material is accommodated, preferably being generally smaller than those of the pests to be controlled.

15 The surface may comprise part of a tubular trap, preferably of triangular cross-section and being open-ended optionally, in which case, the surface may be an interior surface of the trap of which at least part, and preferably a major proportion, may be coated with the particulate material which, if a fine powder or otherwise, may be charged electrostatically, preferably by friction.

20 The electrostatic charge on the powder discharges more rapidly in high humidity environments and, irrespective of climatic conditions, wind blowing through the trap tends to remove eventually the powder completely therefrom.

25 Accordingly, it is a further object of the invention to provide a pest control trap wherein such removal or other loss of the particulate material, such as a fine powder, from the interior surface of the trap is eliminated or at least substantially reduced.

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Thus, a third aspect of the invention resides in a pest control trap comprising a surface having at least one recess therein, wherein a particulate material incorporating a pest killing or behaviour-modifying agent, is accommodated in the or each recess.

Preferably, the or each recess, which is preferably discrete, has dimensions which are generally smaller than those of pests to be controlled. Advantageously, the particulate material is capable of being rendered airborne by movement of a pest in the vicinity thereof. Also, the particulate material, such as a fine powder, may be capable of being charged electrostatically, preferably by friction, as it is rendered airborne, for subsequent contamination of a pest in the vicinity thereof.

A fourth aspect of the invention is directed to a method of preventing the dispersion of a pest-contaminating particulate material from a pest trap, which method comprises accommodating the material, such as a fine powder, in at least one recess in a surface of the trap.

Thus, this inventive method protects the pest-contaminating particulate material from wind action and ensures that it can be attached to a pest, such as a flying insect pest, as it flies above or takes-off from the surface. By using the downthrust of air generated by such a pest's wing beats to render the particulate material, such as a fine powder, airborne, it also ensures at the same time that the powder can become charged electrostatically, so that it will adhere to the pest.

In one embodiment of the invention, and as discussed above, there is provided a plate, preferably made of a plastics material, whose surface has an array of recesses associated therewith, preferably in the form of holes, apertures, cavities or other indentations of smaller diameter than the body length of the target pest.

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5 This plate may be placed in the bottom of a pest monitoring trap, normally, but not necessarily, in a generally horizontal plane in use. The particulate material, preferably in the form of a fine powder and whether it be charged or uncharged, is accommodated in the recess(es) and, in this manner, is protected from the undesirable effects of wind action or other air currents. Also, the trap need contain no sticky materials or other pest-retaining devices, so that pests can enter and leave the inventive trap readily. In one embodiment, the plate may also constitute the base of the trap.

10 It is well known that when a flying pest, such as a flying insect pest, is airborne, it gains lift by providing downward momentum to the air around it. It can be calculated that a flying insect pest, such as a mosquito weighing about 1 milligram, can generate a downward air velocity of 0.5 ms^{-1} , whilst a larger flying insect pest, such as a large moth weighing about 1 gram, can generate a
15 downward air velocity of 1 ms^{-1} . Additionally, it is known that during take-off, flying insect pests can generate extra lift by generating vortices on the downward strokes of their wings, which vortices are then directed downwardly (Kingsolver, Scientific American 1985).

20 A flying insect pest which lands on, say, the plate of the embodiment of inventive trap discussed above, and then takes-off or hovers above it, will displace air downwardly at comparatively high velocity. This is sufficient to render the particulate material, such as a fine powder, on the plate, airborne and as the powder becomes detached from the surface of the plate, it can, under certain circumstances,
25 acquire an electrostatic charge. The polarity of any such charge will depend upon the nature of the particulate material and of the surface which it bears and, thus, can be adjusted so that it is of opposite polarity to that of the surface of the body of the insect pest. In this way, the movement of a flying insect pest can be used to produce an appropriate electrostatic charge on the particles of particulate material,

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as well as rendering them airborne. The electrostatically-charged particles of particulate material, such as a fine powder, will tend to settle on the insect pest, its being attracted towards it from very short distances.

5 Thus, it can be seen that the various aspects of the invention provide means for:

1. coating pests, such as insect pests, with a powder whose particles are capable of being rendered airborne by the pests' own movements;
- 10 2. reducing loss of powder from a pest control trap or "bait" station by wind or other air currents;
3. controlling powder loss by accommodating the powder or other particulate material in recesses associated with a surface of a pest control trap, such recess(es) being smaller in dimension than the pests;
- 15 4. controlling, in particular, flying insect pests by coating them with powder or other fine particulate material which can be charged electrostatically, for example by friction, as it is rendered airborne by the pests' movements;
- 20 5. controlling insect pests, in particular, by using powders of other particulate material incorporating biological, synthetic and/or natural pesticides; and
- 25 6. controlling crawling pests, for example, insect pests, by using a particulate material which can be rendered airborne by the pests running across a surface bearing the particulate material.

In order that the various aspects of the invention may be more fully

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understood, preferred embodiments in accordance with at least some of them will now be described by way of example and with reference to the accompanying drawings in which:

5 Figure 1 is a sectional perspective view of one embodiment of pest control trap;

Figures 2 and 3 are respective plan and sectional views of a base plate of the trap shown in Figure 1; and

10 Figures 4 and 5 are respective perspective and side elevational views of another embodiment of pest control trap.

Referring firstly to Figures 1 to 3 of the accompanying drawings, an open-ended trap, indicated generally at 1 in Figure 1, for monitoring flying insect pests, is of generally triangular cross-section and comprises a base plate, indicated generally at 2, which has been placed inside the casing 3 of the open-ended trap 1, to replace the conventional sticky surface which is commonly used in such traps.

20 The base plate 2, as shown in Figures 2 and 3, defines an upper surface 4 thereof and has a central cavity 5 containing an odour attractant (not shown) of suitable formulation, for example, a semiochemical, such as a pheromone or a parapheromone, for attracting flying insect pests into the trap where they can land on and take-off from the upper surface 4 of the plate 2.

25 Within the surface 4 of the base plate 2 is provided a regular array of circularly cross-sectioned, downwardly-tapering recesses 6 in which is accommodated a particulate material in the form of a fine powder, as shown at 7 in Figure 3, which incorporates a pest-killing or behaviour-modifying agent and which

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is sufficiently fine for it to be capable of being rendered airborne by the movement of the pests, for example, the wing beats thereof, on, above or in the region of the powder-bearing surface 4. In this manner, the powder 7 forms a fine cloud thereof above the surface 4, thereby contaminating the insect pests flying above it and any others flying through the trap 1. Preferably, the maximum diameter of the recesses 6, namely, that at the open tops thereof, is less than, say, the body lengths of the pests.

As discussed above, the trap 1, or at least its base plate 2 and associated components, may be made of an electrically insulating material, for example, a suitable plastics material, and the powder 7 may be capable of being charged electrostatically, preferably by friction, as it is rendered airborne by the wing beats or other movements of the flying insect pests in the vicinity thereof. In this way, the electrostatically-charged powder particles adhere to the insect pests, thereby contaminating them and, possibly, allowing them to contaminate other insect pests of the opposite sex during mating attempts.

Various modifications can be incorporated into the pest monitoring trap 1, for example, to reduce loss of the powder 7 by wind action or other air currents blowing through it. Such modifications may include raised edges 9 at the periphery of the plate 2, which edges may be rounded to reduce turbulence being generated over the plate 2. Additionally or alternatively, the recesses 6 may be provided with raised edges 10 around their upper peripheries which may also be used for the same purpose.

The plate 2 may be preformed and arranged to stand alone, for example, by means of the feet 8, as shown in Figures 2 and 3, or designed to fit into conventional insect traps of various shapes and sizes. Alternatively, the recesses 6 may be formed during the manufacture of the trap 1 in, for example, the base wall

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of the casing 2.

In the embodiment of pest monitoring trap 1 discussed above with reference to Figures 1 to 3, the base plate 2, and hence the powder-bearing surface 4, lies in a generally horizontal plane during use. However, the orientation of the plane of the base plate 2, and hence that of the powder-bearing surface 4, may be vertical or at any suitable angle thereto.

Such a vertical orientation of the plate and associated powder-bearing surface is shown in the second embodiment of pest monitoring trap, as indicated generally at 11 in Figures 4 and 5. This vertical orientation of the powder-bearing surface 14 of the plate 12 is, in certain circumstances, desirable because some species of flying insect pest, for example, the olive fruit fly, land preferentially on vertical surfaces.

In the second embodiment of flying insect pest monitoring trap shown in Figures 4 and 5, the opposed vertical surfaces 14 of the plate 12 are again provided with recesses, this time in the form of troughs 16, in which is accommodated, once again, a pest-killing or behaviour-modifying powder which is capable, namely, sufficiently fine, of being rendered airborne as a result of the wing beats or other movements of flying insect pests in the region thereof.

The trap 11 is provided with a roof 13 for preventing rainwater from accumulating in the troughs 16, whilst a source 15 of odour attractant, such as that discussed above in relation to the first embodiment of Figures 1 to 3, is provided at the upper region of the plate 12.

Thus, flying insect pests are attracted to the trap 11 by a combination of visual features, including colour, and the odour attractant 15, again as in the case of

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the first embodiment.

5 The troughs 16 in which the powder is accommodated, may be placed at an angle to their respective surfaces 14, or, as shown in Figures 4 and 5, may be in the form of cup- or trough-shaped projections, namely, the troughs 16.

10 The shape of the powder-accommodating recesses 6 of the first embodiment of trap 1 and the corresponding troughs 16 of the second embodiment of trap 11 may also be such that any turbulence of air flowing into them is reduced, which might otherwise lead to vortex formation. For example, they may be V-shaped in vertical section, such as the recesses 6 shown in the first embodiment of trap 1 of Figures 1 to 3. Alternatively, the recesses may also consist of channels in the base plate 2 which can be rectilinear, curved, concentric or spiral. The recesses may be discrete, such as those shown at 6 in the first embodiment of trap 1 or may be substantially continuous, for example, the effectively powder-bearing surface 4 of the plate 2 of the trap 1 may be corrugated.

15 By suitable modification, the respective recesses 6 and troughs 16 of the first and second embodiments of trap 1, 11 may be rendered suitable for crawling insect pests and, indeed, other walking pests, whereby the pests disturb the particulate material, for example, the powder 7 of the first embodiment, by their movement, such as running, across the surface 4, 14.

20 The efficiency of the inventive trap and its powder-bearing surface 4 of the plate 2 was demonstrated in the following experiments.

25 Two plastics plates 2, each 120 x 180 mm, were placed in a horizontal plane inside respective, separate cages, each 900 x 550 x 600 mm, in the laboratory, each cage containing 50 houseflies (*Musca domestica* L.). Each plate 2

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had a chemical lure (protein + (Z)-9-tricosene) at its centre, for example, in a central cavity 5.

5 One plate 2, in accordance with the invention, had ninety six recesses 6, each 6 mm in diameter and 8 mm deep, with generally V-shaped vertical sections, in the surface 4 of the plate 2.

10 The second plate was of conventional, prior art design, having a smooth surface with no recesses therein and covered with a thin layer of carnauba wax powder weighing 0.32 grams. 0.16 grams of the same material was placed in the recesses 6 of the inventive plate 2.

15 After twenty four hours, 52% of the flies in the cage containing the first inventive plate 2 were contaminated with more than fifty particles of the powder, per fly, against only 16% of the flies exposed to the powder-bearing surface of the second prior art plate. By weighing, it was found that the first plate had lost only 37.5% of its powder, whilst the second plate had lost 68.5%.

20 In a second experiment, the first inventive plate 2 described above was charged with 0.09 grams of carnauba wax powder accommodated in the recesses 6. It was then placed in a horizontal position in the centre of a standard fly testing room, 28m² in area with plain white walls, floor and ceiling with a hundred houseflies and left for five days. At the end of that period, all the flies were coated with powder to the extent of at least 500 powder particles per fly, the amount of
25 powder removed from the plate 2 being approximately 0.01 grams, namely, approximately only 10% of the original amount.

In a third experiment, a concentrated jet of carbon dioxide gas from a pressurised cylinder was directed across the surface of each of the first and second

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plates for 5 seconds at a velocity of approximately 1 metre per second. Only 18% of the powder was removed from the recesses 6 of the first inventive plate 2, whilst 63% of the powder was removed from the smooth second prior art plate.

5 In a fourth experiment, the first inventive plate 2 described above was charged with 1.0 grams of carnauba wax powder accommodated in the recesses 6, and then placed horizontally in the bottom of a triangular monitoring trap in place of the normal sticky card. Three traps prepared in this way were then left
10 during which time they were exposed to average early summer climatic conditions. Three traps were similarly prepared but with the powder on a flat acetate sheet, to which the powder was initially adhered by electrostatic forces.

15 At the end of one week, an average of less than 1% by weight of the powder had been lost from the traps with the inventive plate, while an average of approximately 50% had been lost from the traps with the acetate sheet.

20 Thus, it will be appreciated that the invention enables the coating of pests, such as flying or crawling insect pests, with a pest-killing or behaviour-modifying agent using a vector particulate material capable of being rendered airborne by the pests' own wingbeats or other movements. Also, the loss of the particulate material, such as the powders discussed above, from the inventive pest control trap, by wind or other air currents, is reduced, in some instances, considerably. Further,
25 the loss of particulate material can be controlled by accommodating it in recesses associated with a surface of the inventive pest control trap. Moreover, flying insect pests in particular can be controlled by coating them with powder of other fine particulate material which can be charged electrostatically, for example by friction, as it is rendered airborne by the pests' movements. Such particulate material can incorporate biological, synthetic and/or natural pesticides and may also be rendered

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airborne by the pests traversing, by walking or running, the surface bearing that material, as described above in connection with the preferred embodiments.

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CLAIMS

- 1 A method of controlling a pest by at least partially coating the pest with a particulate material (7, 17) incorporating a killing or behaviour-modifying agent, which method comprises directing, attracting or otherwise luring the pest on to, above, or otherwise adjacent a surface (4, 14) bearing such a particulate material (7, 17) to render the material (7) airborne by the movement of the pest on, above, or in the region of the particulate material-bearing surface (4, 14).
- 2 A method according to claim 1, wherein the particulate material (7, 17) is a powder which is sufficiently fine for it to be rendered airborne by a pest moving across flying above or adjacent, or taking-off from the particulate material-bearing surface (4, 14), so that the pest becomes at least partially coated with the powder.
- 3 A method according to claim 2, wherein the powder (7) comprises or is combined with at least one biological, synthetic or natural pesticide as a killing agent.
- 4 A method according to claim 1, 2 or 3, wherein the pest is an insect pest.
- 5 A method according to any preceding claim, wherein the particulate material (7, 17) is charged electrostatically as it is rendered airborne from the particulate material-bearing surface (4, 14).
- 6 A method according to claim 5, wherein the particulate material (7) is charged by friction.

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7. A method according to any preceding claim, wherein the surface (4, 14) is associated with a trap (1, 11), comprising an electrically insulating material.
8. A method according to claim 7, wherein the electrically insulating material comprises a plastics material.
9. A method according to any preceding claim including providing a pheromone or parapheromone attractant (5, 15) for luring pests to be controlled.
10. A method according to any preceding claim, wherein the surface (4) is coated with a fine powder (7) which is charged electrostatically.
11. A method according to claim 10, wherein the powder (7) is capable of retaining its electrostatic charge for long periods on the surface (4).
12. A method according to any preceding claim, wherein undesired removal or loss of the particulate material (7, 17) from the surface (4, 14) is eliminated or at least substantially reduced.
13. A method according to claim 12, wherein undesired removal or other loss of the particulate material (7) from the surface (4) is eliminated or at least substantially reduced by means of raised edges (9), preferably rounded, at the periphery of the surface (4).
14. A method according to any preceding claim, wherein the particulate material (7, 17) is accommodated in at least one recess (6) or trough (16) associated with the particulate material-bearing surface (4, 14).
15. A method according to claim 14, wherein the particulate material (7) is

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accommodated in at least one recess (6) provided in the particulate material-bearing surface (4).

5 16. A method according to claim 15, wherein the upper periphery of the or each recess (6) is provided with raised edges (10).

10 17. A method according to any preceding claim, wherein the particulate material-bearing surface (4) is provided on a plate (2) which is preformed and stands alone, preferably upon feet (8).

18. A method according to claim 14, wherein the particulate material-bearing surface (14) comprises at least one trough (16) in which the particulate material (17) is accommodated.

15 19. A method according to any of claims 14 to 18, wherein the dimensions of the or each recess (6) or the or each trough (16), as the case may be, in which the particulate material (7, 17) is accommodated, are generally smaller than those of the pests to be controlled.

20 20. A method according to any of claims 1 to 16 and 19, wherein the surface (4) comprises part of a tubular trap (1).

25 21. A method according to claim 20, wherein the trap (1) is provided with a triangular cross-section.

22. A method according to claim 20 or 21, wherein the surface (4) is an interior surface of the trap (1).

23. Pest control apparatus comprising a surface (4, 14) on to, above or in the

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5 region of which a pest is capable of being directed, attracted or otherwise lured and which bears a particulate material (7, 17) incorporating a killing or behaviour-modifying agent, wherein the particulate material (7, 17) is capable of being rendered airborne by movement of the pest on, above, or in the region of the particulate material-bearing surface (4, 14).

10 24. Apparatus according to claim 23, wherein the particulate material (7, 17) is a powder which is sufficiently fine for it to be rendered airborne by a pest moving across, flying above, or in the region of, or taking-off from the particulate material-bearing surface (4, 14), so that the pest, becomes at least partially coated with the powder.

15 25. Apparatus according to claim 24, wherein the powder (7, 17) comprises or is combined with at least one biological, synthetic or natural pesticide as a killing agent.

26. Apparatus according to claim 23, 24 or 25, wherein the pest is an insect pest.

20 27. Apparatus according to any of claims 23 to 26, wherein the particulate material (7, 17) has properties which enable it to become charged electrostatically as it is rendered airborne from the particulate material-bearing surface (4, 14).

25 28. Apparatus according to claim 27, wherein the particulate material (7, 17) is chargeable by friction.

29. Apparatus according to any of claims 23 to 28, wherein the surface (4, 14) is associated with a trap (1, 11), comprising an electrically insulating material.

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30. Apparatus according to claim 29, wherein the electrically insulating material comprises a plastics material.
- 5 31. Apparatus according to any of claims 23 to 30 comprising a pheromone or parapheromone attractant (5, 15).
32. Apparatus according to any of claims 23 to 31, wherein the surface (4) is coated with a fine powder (7) which is charged electrostatically.
- 10 33. Apparatus according to claim 32, wherein the powder (7) is capable of retaining its electrostatic charge for long periods on the trap surface (4).
- 15 34. Apparatus according to any of claims 23 to 33, wherein undesired removal or loss of the particulate material (7, 17) from the surface (4, 14) is eliminated or at least substantially reduced.
- 20 35. Apparatus according to claim 34, wherein undesired removal or other loss of the particulate material (7) from the surface (4) is eliminated or at least substantially reduced by raised edges (9), preferably rounded, at the periphery of the surface (4).
- 25 36. Apparatus according to any of claims 23 to 35, wherein the particulate material (7, 17) is accommodated in at least one recess (6) or trough (16) associated with the particulate material-bearing surface (4, 14).
37. Apparatus according to claim 36, wherein the particulate material (7) is accommodated in at least one recess (6) provided in the particulate material-bearing surface (4).

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38. Apparatus according to claim 37, wherein the upper periphery of the or each recess (6) has raised edges (10).
- 5 39. Apparatus according to any of claims 23 to 38, wherein the particulate material-bearing surface (4) is on a plate (2) which is preformed and stands alone, preferably upon feet (8).
- 10 40. Apparatus according to claim 36, wherein the particulate material-bearing surface (14) comprises at least one trough (16) in which the particulate material (17) is accommodated.
- 15 41. Apparatus according to any of claims 36 to 40, wherein the dimensions of the or each recess (6) or the or each trough (16), as the case may be, in which the particulate material (7, 17) is accommodated, are generally smaller than those of the pests to be controlled.
- 20 42. Apparatus according to any of claims 23 to 38, wherein the surface (4) comprises part of a tubular trap (1).
- 25 43. Apparatus according to claim 42, wherein the trap (1) has a triangular cross-section.
44. Apparatus according to claim 42 or 43, wherein the surface (4) is an interior surface of the trap (1).
45. A pest control trap (1, 11) comprising a surface (4, 14) having at least one recess (6, 16) therein, wherein a particulate material (7, 17) incorporating a pest killing or behaviour-modifying agent, is accommodated in the or each recess (6, 16).

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46. A trap (1, 11) according to claim 45, wherein the or each recess (6, 16) has dimensions which are generally smaller than those of pests to be controlled.
- 5 47. A trap (1, 11) according to claim 45 or 46, wherein the particulate material (7, 17) is capable of being rendered airborne by movement of a pest in the vicinity thereof.
- 10 48. A trap (1,11) according to any of claims 27 to 29, wherein the particulate material (7, 17) is a fine powder.
49. A trap (1,11) according to any of claims 45 to 48, wherein the particulate material (7, 17) is capable of being charged electrostatically.
- 15 50. A trap (1,11) according to any of claims 45 to 49, wherein the particulate material (7, 17) is chargeable by friction as it is rendered airborne, for subsequent contamination of a pest in the vicinity thereof.
- 20 51. A method of preventing the dispersion of a pest-contaminating particulate material (7, 17) from a pest trap (1, 11), which method comprises accommodating the material (7,17) in at least one recess (6, 16) in a surface (4, 14) of the trap (1, 11).
- 25 52. A method according to claim 51, wherein the particulate material (7, 17) comprises a fine powder.
53. A method according to claim 51 or 52, wherein the pest-contaminating particulate material (7, 17) is protected from wind action.
54. A method according to claim 51, 52 or 53, wherein the particulate material (7,

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17) is attached to a pest as it flies in the region of or takes-off from the surface (4, 14).

5 55. A method according to any of claims 51 to 54, wherein the pest is a flying insect pest.

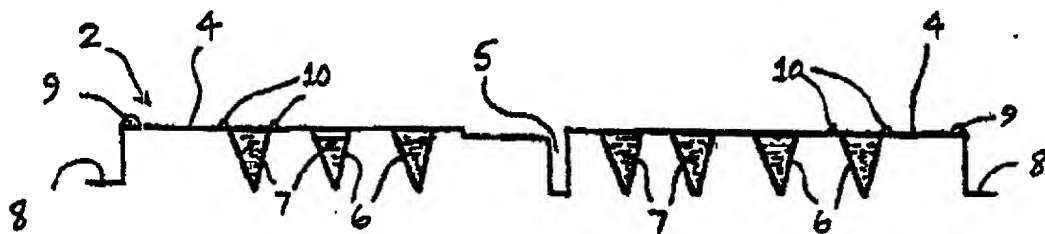
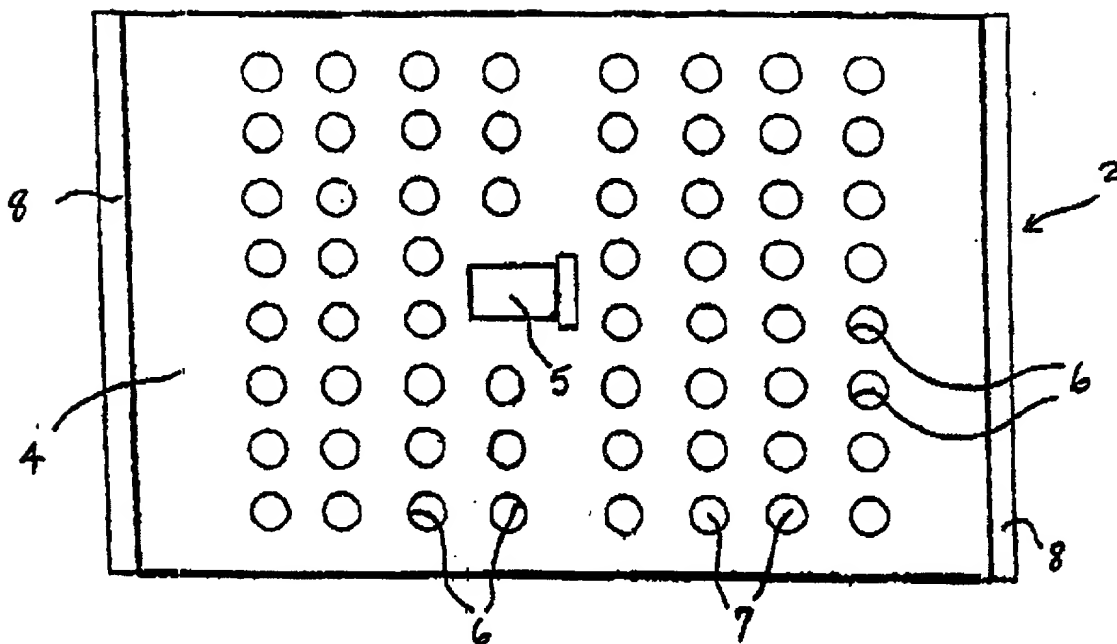
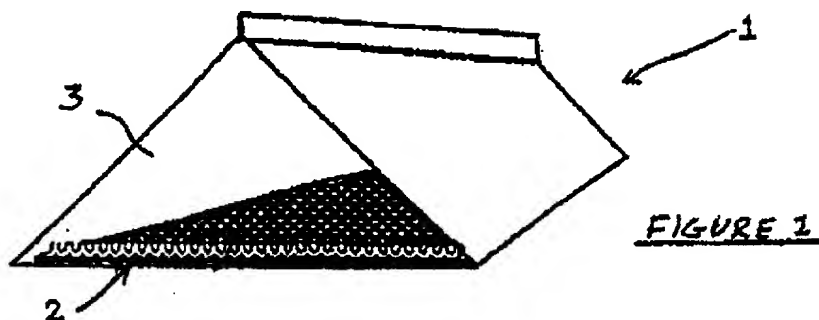
56. A method according to claim 55, wherein downthrust of air generated by the pest's wing beats, renders the particulate material (7) airborne.

10 57. A method according to claim 56, wherein, as the material (7, 17) becomes airborne, it is charged electrostatically, so that it will adhere to the pest.

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FIGURE 4

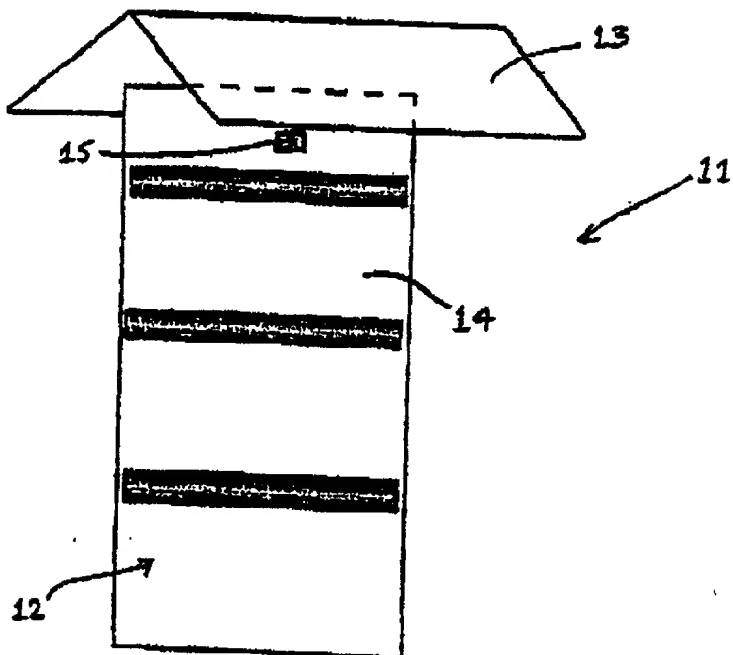
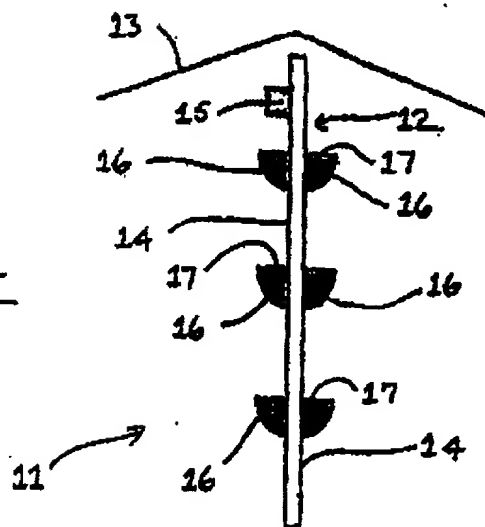


FIGURE 5



DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name; and

I believe I am an original, first and ☐ joint ☐ sole inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled:

PEST CONTROL

described and claimed in

☒ International Patent Application No.: PCT/GB99/01631; Priority date 23 May 1998
☐ the specification filed _____, as U.S. Application Serial No. _____
and as amended _____.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims as filed and as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).


I appoint: Gary M. Hartman, Reg. No. 33,898
Domenica N.S. Hartman, Reg. No. 32,701

as my attorneys with full power of substitution and revocation, to prosecute this application and to transact all business in the United States Patent and Trademark Office connected therewith.

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I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

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Inventor's Residence: _____
- 4) Inventor's Signature: _____ Date: _____
Inventor's Full Name: _____ Citizenship: _____
Inventor's Residence: _____